BUILDING GLOBAL COMMUNICATIONS

EX PARTE

July 16, 2002

Ms. Magalie Roman Salas
Secretary
Federal Communications Commission
445 12th Street, S.W.
Washington, DC 20554

Re: WT Docket No. 96-86: *The Development of Operational, Technical and Spectrum Requirements for Meeting Federal, State and Local Public Safety Agency Communication Requirements Through the Year 2010*

Dear Ms. Salas,

The Private Radio Section ("PRS") of the Wireless Communications Division ("WCD") of the Telecommunications Industry Association ("TIA")[1] respectfully submits the following industry consensus recommendations for changes to FCC Rule Section 90.543[2] that proscribes emission limitations for public safety transmitters operating in the 767-773 MHz and 797-803 MHz ("700 MHz") frequency bands. Commission adoption of these recommendations would expedite the availability of 700 MHz products for public safety providers in full accordance with the Commission's goals.

TIA is an American National Standards Institute ("ANSI")-accredited standards development organization and its product-oriented divisions and their associated engineering committees include technical experts from equipment manufacturers who serve the wireless industry as well as technical user representatives. TIA's engineering committees develop various standards and technical bulletins to address a wide range of requirements, including system performance, interference abatement, compatibility and interoperability. Within this context, TIA's PRS focuses in part on the necessary requirements to support reliable wireless communications responding to the needs of public safety entities. TIA's PRS (through its' sponsored TR-8.6 subcommittee on Equipment Performance Recommendations) prepared the recommendations contained herein.

In its *Second MO&O*[3] in WT Docket No. 96-86, the Commission considered petitions for clarification and reconsideration of its 700 MHz public safety out-of-band emissions limits that are

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1 TIA is the leading trade association serving the communications and information technology industry, with approximately 1,000 member companies that manufacture or supply the products and services used in global communications. TIA represents the communications sector of the Electronic Industries Alliance (EIA). On occasion, a TIA division or section of a TIA division will file in a regulatory proceeding representing the views of only the members of that division or section. These comments are from the Private Radio Section of the Wireless Communications Division.

2 47 C.F.R. § 90.543.

3 *The Development of Operational, Technical and Spectrum Requirements for Meeting Federal, State and Local Public Safety Agency Communications Requirements Through the Year 2010*, WT Docket No. 96-86, *Second Memorandum Opinion and Order*, FCC 00–264 (rel. August 1, 2000) ("*Second MO&O*").

based on the new regulatory concept known as adjacent channel coupled power ("ACCP"), rather than the traditional method of emission masks. The *Second MO&O* noted that while Ericsson and Motorola stated their support for using the ACCP concept, both manufacturers had requested further analysis to finalize the ACCP requirements.[4] In reaching its decision on this matter, the Commission in the *Second MO&O* concluded:

> We agree with Ericsson and Motorola that further industry consensus recommendations would be useful to refine ACCP values. Accordingly, we defer further action on this issue at this time, while retaining the values adopted in our *First Report and Order*. We request that the industry review this technical issue and provide us, within a reasonable time frame (but not to exceed one year), consensus recommendations for values of ACCP emission limits (footnote omitted).[5]

The recommendations contained herein are responsive to this directive and are the work product of the PRS-sponsored TIA Engineering Subcommittee TR-8.6, Equipment Performance Recommendations, which has been working under project No. PN-3-0042 to develop a performance standard for wideband data transceivers operating in the wideband segment of the recently allocated 700 MHz public safety band. These recommendations are the consensus opinion of manufacturers interested in building 700 MHz public safety equipment based on current technology, and are similar in nature to those provided to the FCC in this docket in August of 2001 for narrowband equipment.[6] The recommendations were developed under TIA processes and thus represent full consensus opinions without substantive objections of any participating manufacturer.

The PRS-sponsored TR-8.6 subcommittee's recommendations are embodied in the attached proposed revision to Section 90.543 of the Commission's Rules to change the two tables for 150 kHz transmitter ACCP requirements, and add similar tables for 100 kHz and 50 kHz transmitters. These tables are based on the measurement method, and use the terminology, that were described in the letter for narrowband transmitter ACCP recommendations contained in TIA's PRS August 2001 submission. The six specific tables of recommended 50, 100 and 150 kHz mobile and base station transmitter requirements are contained in the attached Annex 1. These are excerpted from the most recent draft of TIA/EIA-902.CAAB which TR 8.6 plans to release by year-end 2002.

Attention is called to the original FCC proposal of –100 dBc ACP for wideband base station transmitter adjacent channel power attenuation in the paired receive band. TIA's PRS is proposing that this be relaxed from –100 dBc to –85 dBc for base stations. Application of this specification limit under routine field deployment shows that significant amounts of additional attenuation of the transmitter noise in the paired receive band will be required to minimize the impact of the transmitter sideband noise on co–sited receivers, or duplex repeater configurations. The need for this additional attenuation is evident in the example co-site engineering analysis contained in the attached Annex 2 that shows a need for 41 dB additional attenuation for a 50 Watt wideband data transmitter operating on a 50 kHz channel. Due to the difference in bandwidth of receivers compared to the 50 kHz channel data receiver, an additional attenuation of 5 dB is necessary for the same level of protection for 150 kHz channel receivers. This additional attenuation is routinely provided in site engineering design by cascading commercially available filters external to the transmitter. The duplex mode of operation is an intra-transceiver mode of operation resulting in a self-interference case and is assumed to be self-correcting by the manufacturer least repeater

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4 *Id.* at ¶15.

5 *Id.* at ¶16.

6 See Comments of the Private Radio Section of the Wireless Communications Division of the Telecommunications Industry Association in WT Docket No. 96-86 (Aug. 23, 2001)

operation be infeasible. The additional 15 dB of protection can be easily provided by the external filtering instead of by attenuation of out-of-band emissions within the transmitter and thus permit relaxation of the –100 dBc base station ACP requirement to –85 dBc.

Attention is also called to the current FCC requirement of –100 dBc ACP for narrowband base station transmitter adjacent channel power attenuation in the paired receive band. TIA's PRS is proposing that this also be relaxed from –100 dBc to –85 dBc for narrowband base stations. Again, filters are normally cascaded external to the transmitter to attenuate transmitter noise below the levels required to protect the co-sited, paired base receiver, lowering the levels of out-of-band emissions radiated.

The adjacent channel power concept to measure out-of-band emissions limits is a more flexible and precise means of providing in-band interference protection to 700 MHz public safety and Guard Band users. TIA's PRS commends the FCC for recognizing this fact and adopting new industry conventions. FCC adoption of these recommended enhancements to the current rules will expedite product delivery in this new service by eliminating uncertainty and adding clarity where needed. The PRS urges the FCC to move quickly in implementing these changes, as manufacturers are eager to begin submitting applications for 700 MHz equipment authorizations.

Reference for 700 MHz Receiver Standards

The FCC's National Coordinating Committee has recommended that performance limits for Class A receivers, as defined in ANSI/TIA/EIA-102.CAAB, be adopted for equipment authorized to work on the 700 MHz interoperability channels. TIA subcommittee TR 8.6 is currently in the ballot phase for ANSI/TIA/EIA-102.CAAB-A intended to supercede ANSI/TIA/EIA-102.CAAB. It is recommended that the FCC adopt ANSI/TIA/EIA-102.CAAB-A as the reference standard instead, as it is an update specifically prepared to address the 700 MHz public safety band.

Respectfully submitted,
Private Radio Section
Wireless Communications Division
Telecommunications Industry Association

By: ___/s/____________________________

Wayne Leland
Chairman
Private Radio Section

Bill Belt
Director, Technical Regulatory Affairs

Derek Khlopin
Director, Law & Public Policy

1300 Pennsylvania Avenue NW, Suite 350
Washington, DC 20004
202.383.1482

Annex 1

Proposed Revision of 47 CFR 90.543(a)

Replace the existing two tables for 150 kHz mobile and transmitter ACCP requirements for transmitters designed to operate in 767 – 773 MHz and 797 – 803 MHz frequency bands with the following six tables:

50 kHz Mobile Transmitter ACP Requirements

Offset from Center Frequency (kHz)	Measurement Bandwidth (kHz)	ACP (dBc)
50	50	-40
100	50	-50
150	50	-50
200	50	-50
250	50	-50
300	50	-50
350	50	-50
400	50	-50
450	50	-50
500	50	-50
550	50	-50
600 to 1000	30 (s)	-60
1000 to 2000	30 (s)	-65
2000 to 9000	30 (s)	-70
9 MHz to paired Receive Band	30 (s)	-70
In the paired Receive Band	30 (s)	-100

100 kHz Mobile Transmitter ACP Requirements

Offset from Center Frequency (kHz)	Measurement Bandwidth (kHz)	ACP (dBc)
75	50	-40
125	50	-50
175	50	-50
225	50	-50
275	50	-50
325	50	-50
375	50	-50
425	50	-50
475	50	-50
525	50	-50

575	50	-50
600 to 1000	30 (s)	-60
1000 to 2000	30 (s)	-65
2000 to 9000	30 (s)	-70
9 MHz to paired Receive Band	30 (s)	-70
In the paired RX Band	30 (s)	-100

150 kHz Mobile Transmitter ACP Requirements

Offset from Center Frequency (kHz)	Measurement Bandwidth (kHz)	ACP (dBc)
100	50	-40
150	50	-50
200	50	-50
250	50	-50
300	50	-50
350	50	-50
400	50	-50
450	50	-50
500	50	-50
550	50	-50
600 to 1000	30 (s)	-60
1000 to 2000	30 (s)	-65
2000 to 9000	30 (s)	-70
9 MHz to paired Receive Band	30 (s)	-70
In the paired RX Band	30 (s)	-100

50 kHz Base Transmitter ACP Requirements

Offset from Center Frequency (kHz)	Measurement Bandwidth (kHz)	ACP (dB)
50	50	-40
100	50	-50
150	50	-50
200	50	-50
250	50	-50
300	50	-55
350	50	-55
400	50	-60
450	50	-60
500	50	-60
550	50	-60
600 to 1000	30 (s)	-65
1000 to 2000	30 (s)	-70

2000 to 9000	30 (s)	-75
9 MHz to paired Receive Band	30 (s)	-75
In the paired Receive Band	30 (s)	-85

100 kHz Base Transmitter ACP Requirements

Offset from Center Frequency (kHz)	Measurement Bandwidth (kHz)	ACP (dBc)
75	50	-40
125	50	-50
175	50	-50
225	50	-50
275	50	-55
325	50	-55
375	50	-55
425	50	-60
475	50	-60
525	50	-60
575	50	-60
600 to 1000	30 (s)	-65
1000 to 2000	30 (s)	-70
2000 to 9000	30 (s)	-75
9 MHz to paired Receive Band	30 (s)	-75
In the paired Receive Band	30 (s)	-85

150 kHz Base Transmitter ACP Requirements

Offset from Center Frequency (kHz)	Measurement Bandwidth (kHz)	ACP (dBc)
100	50	-40
150	50	-50
200	50	-50
250	50	-50
300	50	-55
350	50	-55
400	50	-60
450	50	-60
500	50	-60
550	50	-60
600 to 1000	30 (s)	-65

1000 to 2000	30 (s)	-70
2000 to 9000	30 (s)	-75
9 MHz to paired Receive Band	30 (s)	-75
In the paired Receive Band	30 (s)	-85

Annex 2

CO-SITE ENGINEERING ANALYSIS EXAMPLE

An analysis of the base station transmitter noise in the receiver in a 50 kHz channel in the paired receive band follows based on the Scalable Adaptive Modulation (SAM) system being developed by Motorola and standardized in the TIA 902 series of standards. The receiver protection criterion was that the transmitter noise in the paired receive band produces less than 1 dB degradation of the victim receiver sensitivity. The base station transmitter output power was set to 50 W, and it was necessary to make some assumptions with respect to the receiver parameters. Since this an example some of the assumed parameters may be different in an actual design.

Step 1: Calculate the victim receiver noise floor, N_{RX}.

Receiver Parameters:

KTB:	–174 dBm	Thermal noise in a 1 Hz bandwidth
IF ENBW:	46.3 dB	42.6 kHz
Receiver Noise Figure:	6 dB	Assume high performance receiver front end

N_{RX} = KTB + ENBW + NF
= –174 + 46.3 + 6
= – 121.7 dBm

Step 2: Calculate the transmitter noise in the paired receive band at the ACPR limit value.

Transmitter Power: 47 dBm (50 W)

It is necessary to scale the ACPR measurement bandwidth (BW) to the victim receiver IF bandwidth because they are not the same. The BW of the ACPR measurement is 30 kHz versus the BW of a SAM receiver designed for 50 kHz channel spacing applications is 42.6 kHz.

N_{TX} = Pout (dBm) + ACPR (dBc) + BWcorr
= 47 – 100 + 10log(42.6 kHz/30 kHz)
= 47 – 100 + 1.5
= – 51.5 dBm

Step 3: Calculate the attenuation of the transmitter noise such that the degradation due to the transmitter noise is less than 1 dB.

It can be shown that an uncorrelated signal, that has 6 dB less power than the power in a reference signal, when added to the reference signal, results in a total signal power that is 1 dB greater than the reference signal power. Therefore, if the transmitter noise in the receiver is 6 dB less than the receiver noise floor, the receiver sensitivity will be degraded by less than 1 dB. This degradation limit can be accommodated by setting the noise in the paired receiver due to the co-sited transmitter to be 6 dB less than the receiver noise floor.

Calculate the required transmitter noise attenuation by computing the difference between the transmitter noise floor and the receiver noise floor decreased by 6 dB.

$$
\begin{aligned}
\text{Atten}(N_{TX}) &= N_{TX} - (N_{RX} - 6) \\
&= -51.5 - (-121.7 - 6) \\
&= 76.2 \text{ dB}
\end{aligned}
$$

Step 4: Estimate the isolation between the co-sited transmitter and the victim receiver.

The isolation between antennas on a site is a function of the horizontal and/or the vertical spacing of the transmitter and receiver antennas. Antenna isolation curves were consulted to establish the minimum expected antenna-to-antenna isolation for common antenna configurations. For the same spacing, horizontally oriented antennas have less isolation than vertically oriented antennas (tip to bottom). For two antennas that have a horizontal separation of 10 ft, a common antenna grid spacing, the isolation is approximately 35 dB at 750 MHz. This is a free space loss value. The antenna gains are not included because this case is a near field scenario and the gain pattern of the antennas has not been formed at a distance of 10 feet.

Step 5: Calculate additional attenuation required for less than 1 dB sensitivity degradation.

$$
\begin{aligned}
\text{Additional Attenuation} &= \text{Atten}(N_{TX}) - \text{Antenna Isolation} \\
&= 76 \text{ dB} - 35 \text{ dB} \\
&= 41 \text{ dB}
\end{aligned}
$$

A similar calculation for the narrowband Project 25 receiver case shows that the additional attenuation for the same antenna configuration is 35 dB. In a typical narrowband system, the receiver sensitivity will be better than the limit value specified in the standard. Consequently, the narrowband and wideband cases will require nominally the same amount of transmitter noise attenuation.

Filtering that is supplied may provide the additional attenuation external to the FCC certified base station. Several approaches may be used to implement the additional attenuation or filtering. One method would be to realize additional attenuation by use of cavity filter transmitter combining equipment. Other means of supplying this additional attenuation would be to utilize a transmitter post filter that passes the frequency band of interest, a duplex filter system or combinations of these solutions.